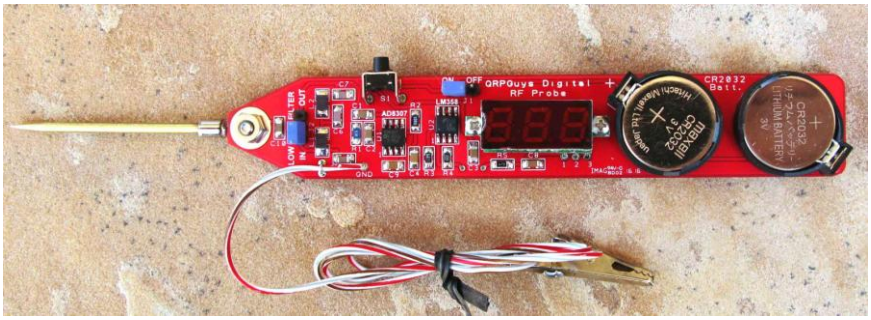
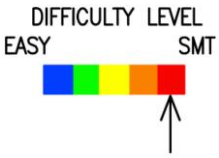
QRPGuys Digital RF Probe





First, familiarize yourself with the parts and check for all the components. If a part is missing, please contact us and we will send one. You must use ***qrpguys.parts@gmail.com*** to request a part.

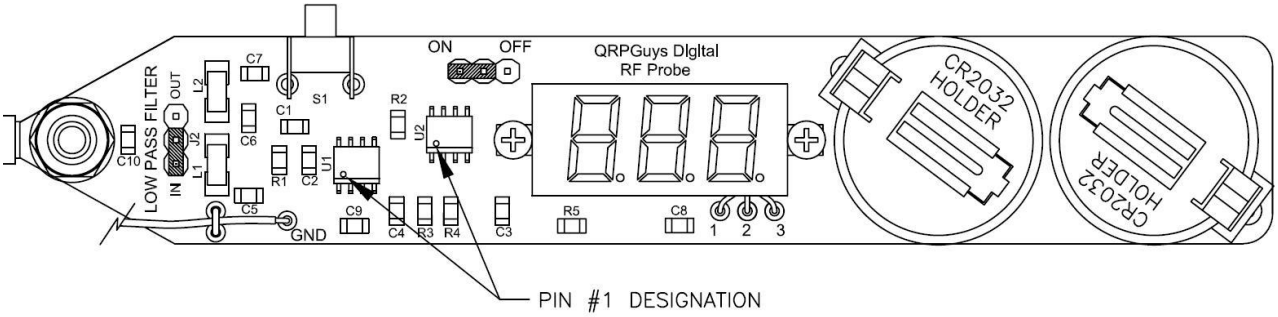
This kit contains seventeen 1206 size SMD components, an AD8307 and LM358 SMD IC. This requires a different skill set than through hole components. These instructions assume you know how to assemble surface mount technology components. These instructions are not written for the first time SMT kit builder.

Parts List

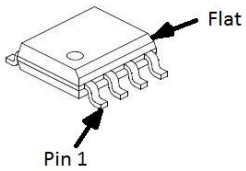
1 – QRPGuys Digital RF Probe PCB
1 – U1, AD8307 SOP-8 case SMD logarithmic detector/amplifier
1 – U2, LM358 SOP-8 case SMD Op Amp
6 – C1, C2, C3, C4, C9, C10, .1uF 1206 SMD capacitor, may be marked “A5”, marked with yellow marker
2 - C5, C7, 82pF 1206 SMD capacitor, may be marked “Y1”, marked with blue marker
1 – C6, 180pF 1206 SMD capacitor, may be marked “G2”, marked with green marker
1 – C8, .001uF 1206 SMD capacitor, may be marked “A3”, marked with violet marker
2 – L1, L2, .360nH(.360uH) 1210 SMD inductor, marked with red marker
1 – R1, 51 ohm 1206 SMD resistor, marked “510” or “51R0” or “51R”
1 – R2, 10 ohm 1206 SMD resistor, marked “100” or “10R0” or ”10R”
1 – R3, 6.8K ohm 1206 SMD resistor, marked “682” or “6811”
1 – R4, 2.2K ohm 1206 SMD resistor, marked “222” or “2211”
1 – R5, 4.7K ohm 1206 SMD resistor, marked “472” or “4711”
1 – S1, horizontal mount, tactile switch
1 – digital voltmeter module, 3 digit, 3 wire
1 – Any 1/4W resistor, for strain relief wire
1 – 18” long teflon insulated wire
1 – small alligator clip
2 – flat CR2032 battery holder
2 – J1, J2, 3 pin header strip
2 – header jumper (Berg connector)
2 – silicone self-adhesive foot, 8mm
1 – 3/32” dia. x 2” long brass rod
1 - ring terminal, #6 x 14/16ga., non insulated
1 – 6-32 x .25”L SS pan head phillips screw
1 – 6-32 SS nut
1 - #6 lock washer
2 – 2-56 x.31”L SS pan head screw
2 – 2-56 SS nut
2 - plastic spacer, #2 x .125”L x .19” dia.
2” - #30AWG wirewrap wire
1 - 1/2” x 1” red mylar

The tools you will need are a soldering iron with a small tip, .02” or smaller diameter rosin core solder, needle nose pliers, tweezers and side cutters. Work over a cookie sheet. Assembly time is about 1-2 hours.

Start with the smallest components first, using the figure below as a guide.



[ ] Install U1, AD8307 IC observing the pin 1 location. Pin 1 is designated as the pin closest to the dot on top, or the corner pin of the side of the chip with the angled flat. *If the leads appear to be tarnished it might be helpful to lightly scrape the tops and bottoms with an exacto knife.*



[ ] Install U2, LM358 IC observing the pin 1 location. Pin 1 is designated as the pin closest to the dot on top, or the corner pin of the side of the chip with the angled flat. *If the leads appear to be tarnished it might be helpful to lightly scrape the tops and bottoms with an exacto knife.*

[ ] Install C1, C2, C3, C4, C9, C10, .1uF SMD capacitors, may be marked “A5”, or yellow marker.

[ ] Install C5, C7, 82pF SMD capacitors, marked “Y1”, or blue marker.

[ ] Install C6, 180pF SMD capacitor, marked “G2”, or green marker.

[ ] Install C8, .001uF SMD capacitor, marked “A3”, or violet marker

[ ] Install R1, 51 ohm 1206 SMD resistor, marked “510” or “51R0” or “51R”

[ ] Install R2, 10 ohm 1206 SMD resistor, marked “100” or “10R0” or “10R”

[ ] Install R3, 6.8K ohm 1206 SMD resistor, marked “682” or “6811”

[ ] Install R4, 2.2K ohm 1206 SMD resistor, marked “222” or “2211”

[ ] Install R5, 4.7K ohm 1206 SMD resistor, marked “472” or “4711”

[ ] Install L1, L2, 360nH(.360uH) inductors, marked with red marker.

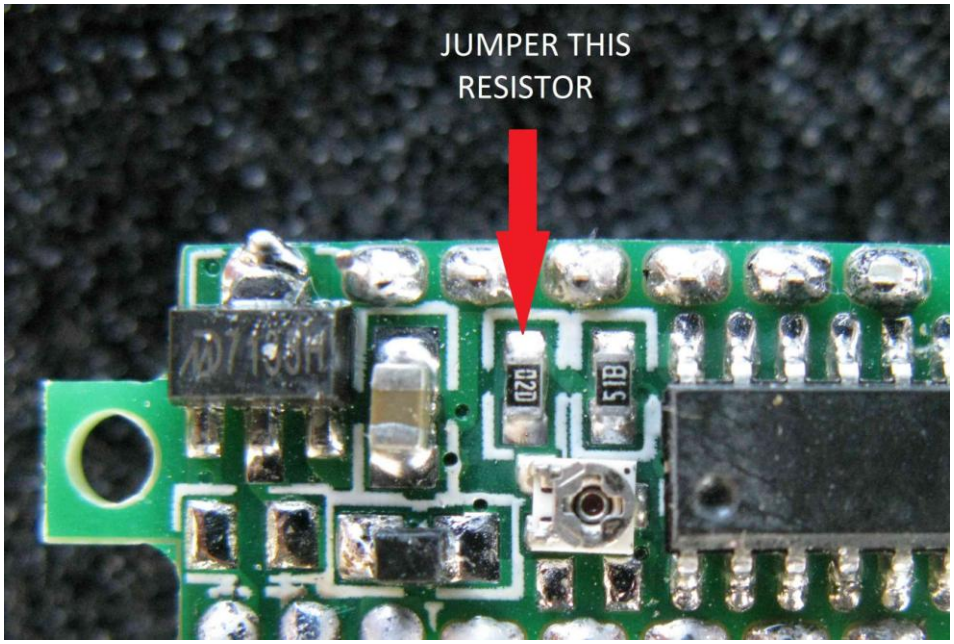
[ ] Install J1, J2, the 3 pin headers.

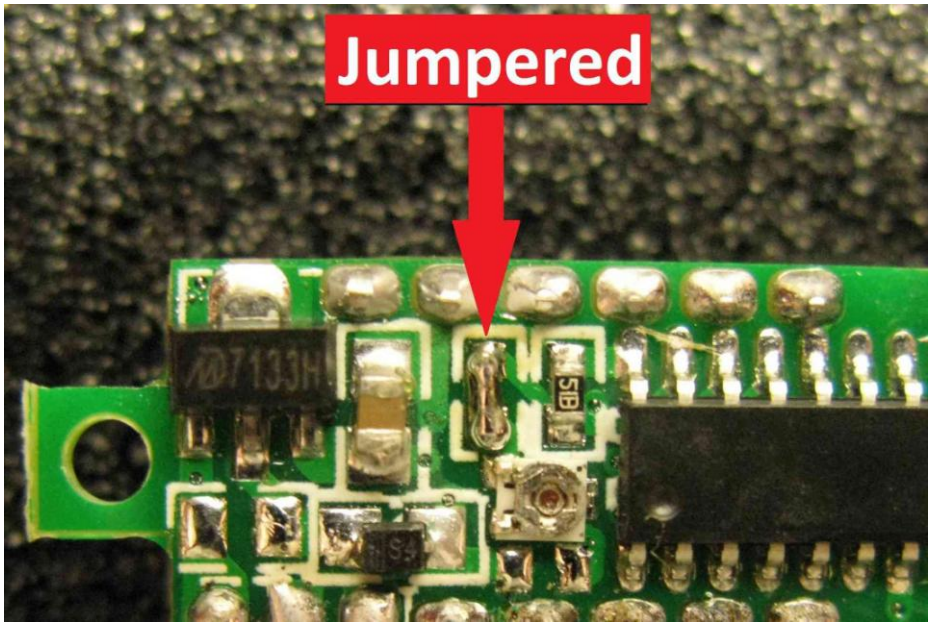
[ ] Install S1. Clip the two leads and mounting tabs flush with the bottom of the PCB.

[ ] Install the two CR2032 battery holders. Clip the mounting tabs flush with the bottom of the PCB.

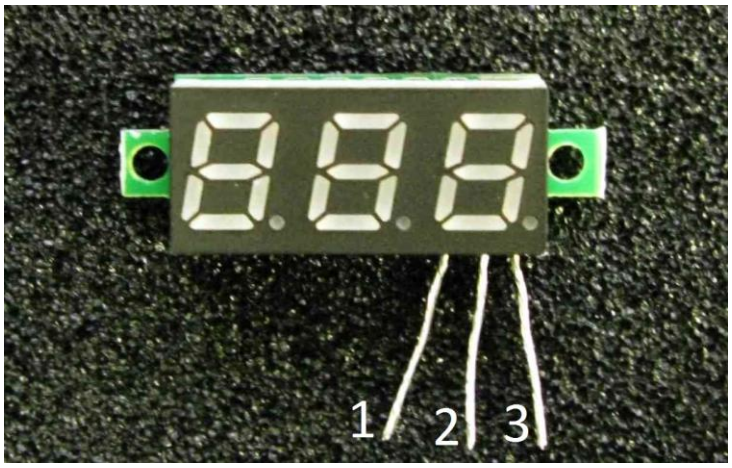
It is necessary to modify the voltmeter to read the 7.0v output of the LM358. You will be modifying the 0-100v digital voltmeter to make it into a 0-7.0v digital voltmeter, but retaining the 0-99.9 scale. This is done by putting jumper over the top of the 102K ohm input scaling resistor therefore bypassing it.

[ ] Use the short piece of wirewrap wire we supply and solder to the top of the resistor shown, jumper across both ends of the resistor. Do this by stripping off about a half inch of the insulation and tack the stripped end of the wire to both ends of the resistor. *Use a small tip and be careful not to short out any other components or connections nearby. Alternately, you can remove the resistor and short the pads.*

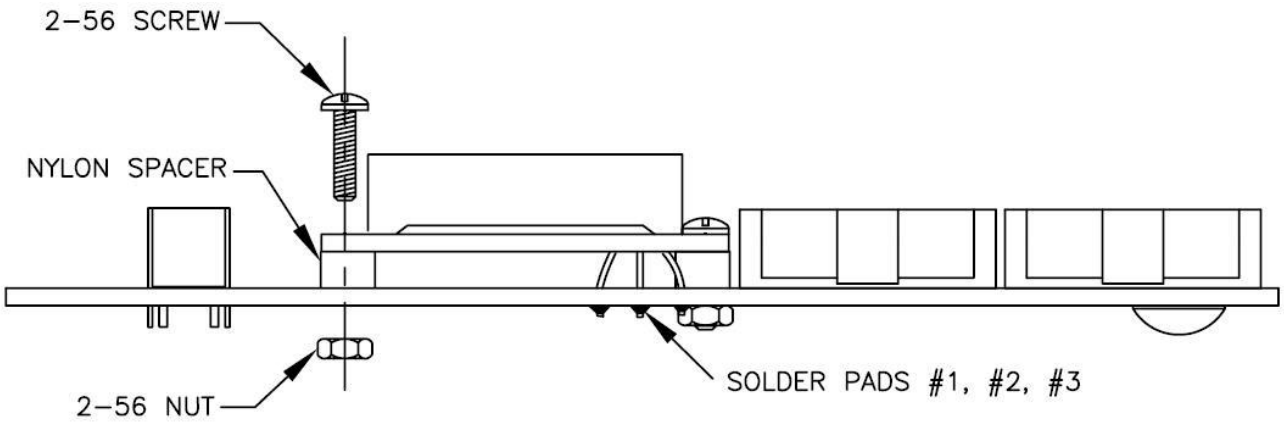




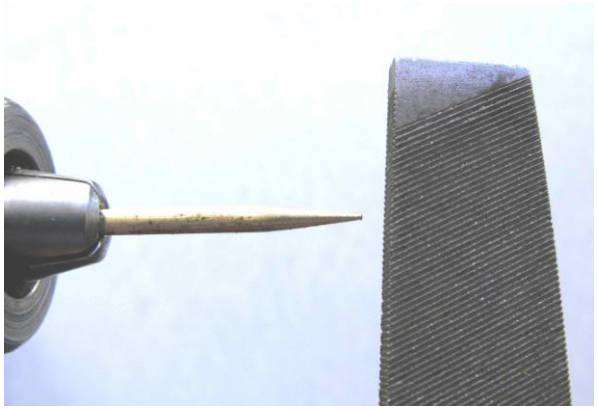
[ ] Prepare the three wires of the digital voltmeter by cutting them 1/2” long. Strip off the insulation, and twist together any of the loose strands, and tin the leads as shown in the picture below.



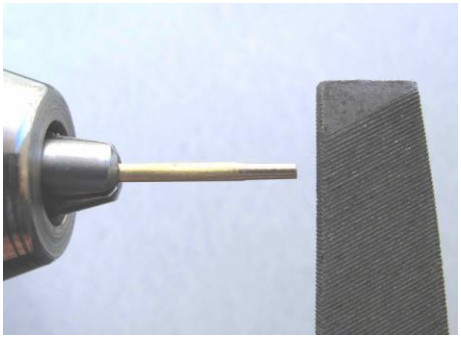
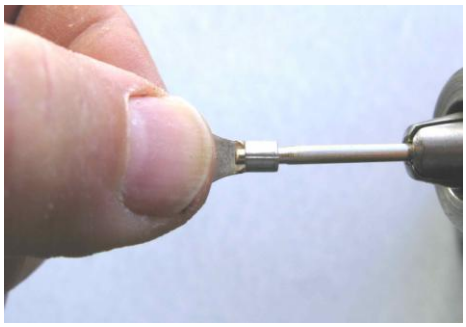
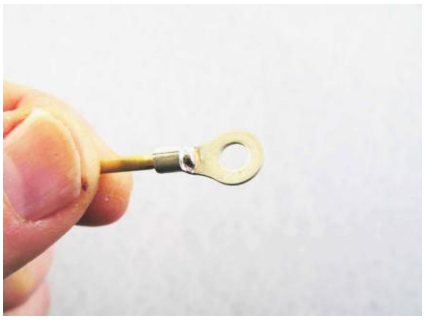
[ ] Feed the three wires through the pcb at pads #1, #2, #3, and mount the digital voltmeter using the 2-56 hardware and nylon spacers as shown in the figure below. Then solder the three wires.



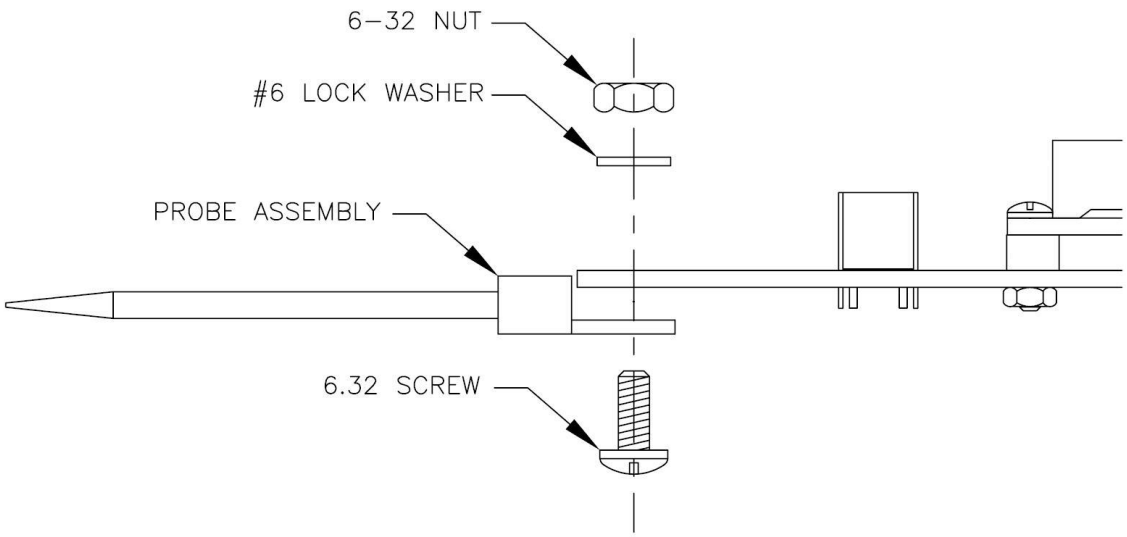
[ ] Prepare the probe tip as shown in the pictures below. Hold the 3/32” diameter brass rod in an electric drill and file a tapered contact point on one end of the probe tip. You might want to polish the brass rod with a piece of scotchbrite if needed.



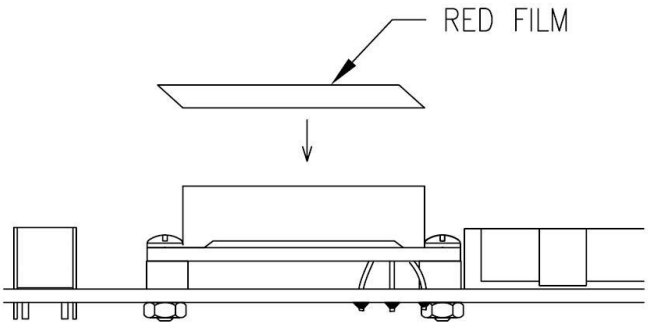
[ ] On the other end, if the rod does not fit into the terminal, file down the brass rod to accept the #6 ring terminal, and solder it in place. The brass rod must be clean to solder.

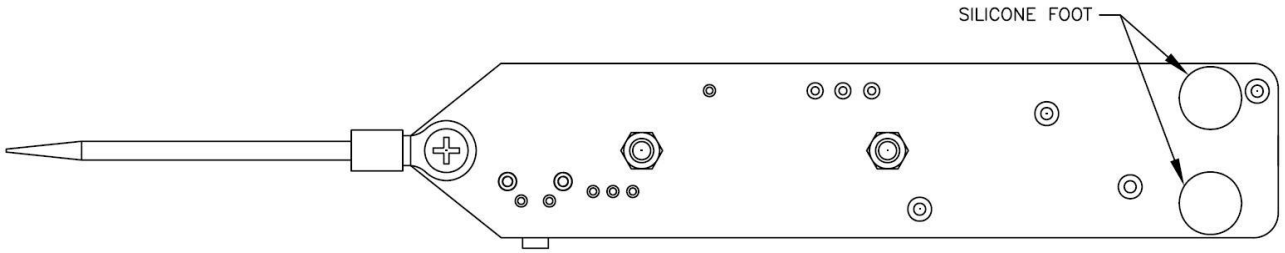
[ ] Use the 6-32 hardware and mount the probe tip to the PCB as shown in the figure below.



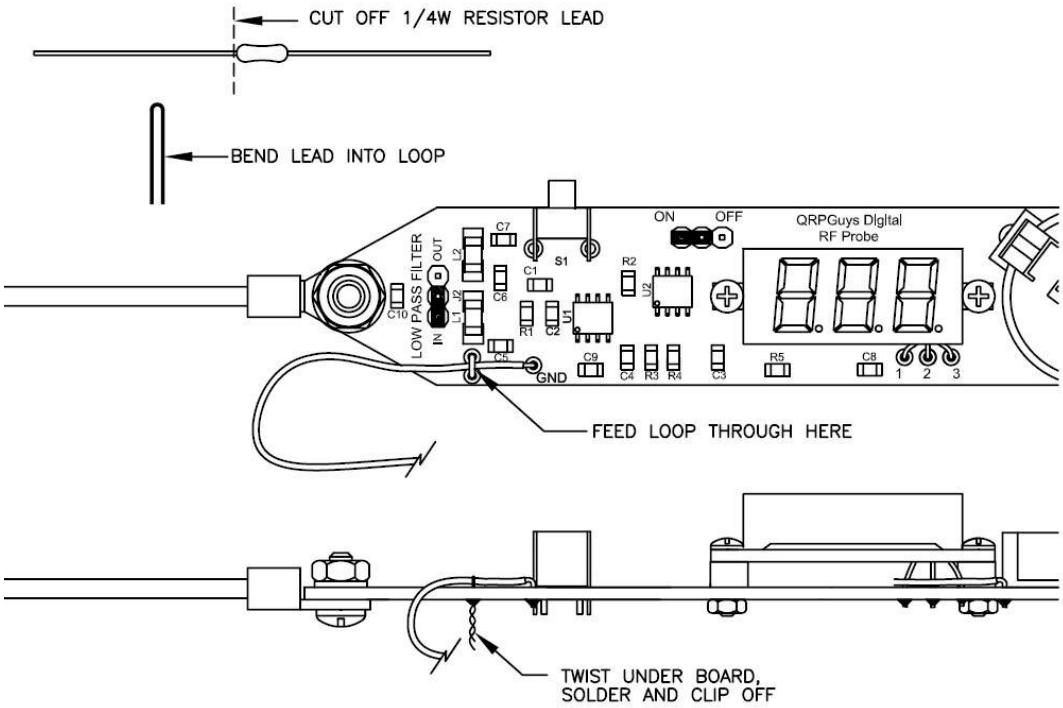
[ ] Cut the piece of red mylar to the same size as the face of the led voltmeter and carefully glue it to the face of the display. A tiny amount of superglue is all that is needed in the four corners.



[ ] Apply the two self-adhesive silicone rubber feet to the bottom of the board as shown in the figure below.



[ ] It is best to keep the ground wire a short as possible to prevent receiving spurious signals, 12” is recommended. Solder the teflon ground wire to the GND pad. Clip the lead off the 1/4W axial resistor and bend the lead into a “U” shape. This forms an efficient strain relief. Feed through the pads shown below and twist the leads together under the board, solder, and clip off excess flush with the board.



[ ] Solder the small alligator clip to the end of the ground wire.

[ ] Install two CR2032 coin cells with the + side of the battery to the top side.

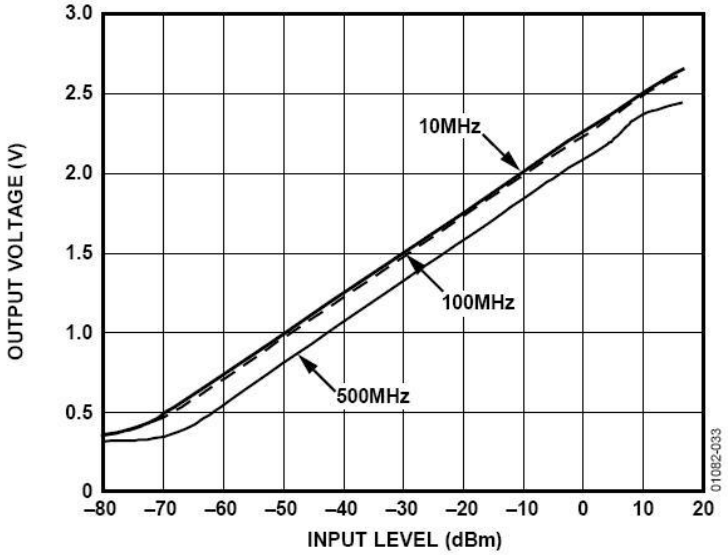
The header jumper at J1 is a simple “on-off” switch for storage. The unit is only powered when the push button is activated, and the header jumper is in the “on” position.

The header jumper at J2 switches the low pass filter in and out of the input circuit.

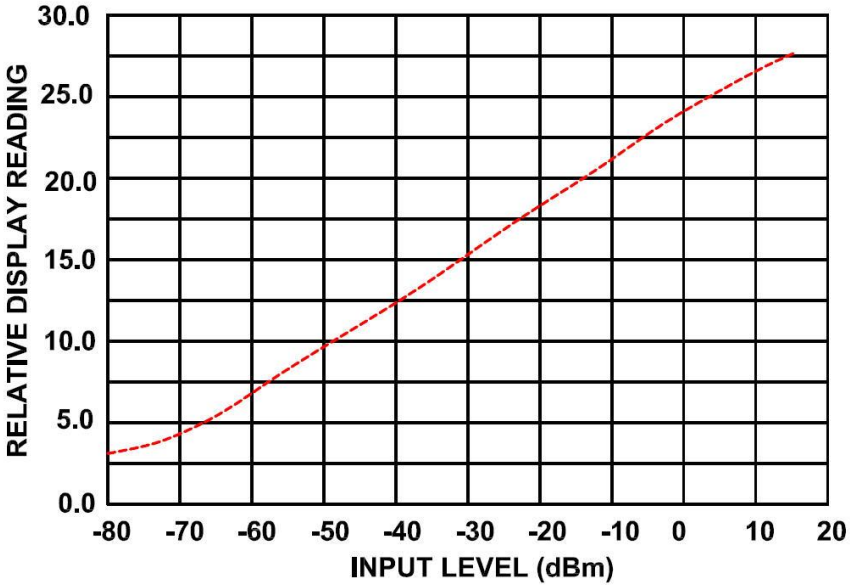
This completes the assembly.

Usage:

Our Digital RF Probe is a very sensitive device used to indicate an RF signal level over a wide range of frequencies, and power levels. The dynamic range should be more than 80 dBm. The maximum RF input level is +16 dBm (1.41 volts). This device should not be used as an RF power meter. The input is protected if you inadvertently touch DC voltages that exceed that, but not RF. Limit your measurements to +10dBm or below to avoid damaging the AD8307. You should be able to detect signals down to -80 dBm (.01nW). Due to the internal modification of the digital voltmeter to increase the sensitivity, the reading on the digital voltmeter is to be used as a relative indicator of RF signal strength in the circuit. The probe can be useful for peaking signal strength in receiver and low power transmitter stage alignment, and following low power RF flow through most stages. The selectable low pass filter will attenuate unwanted >30MHz signals when jumpered at the input. The curves below show the plot of the full dynamic range of the AD8307.



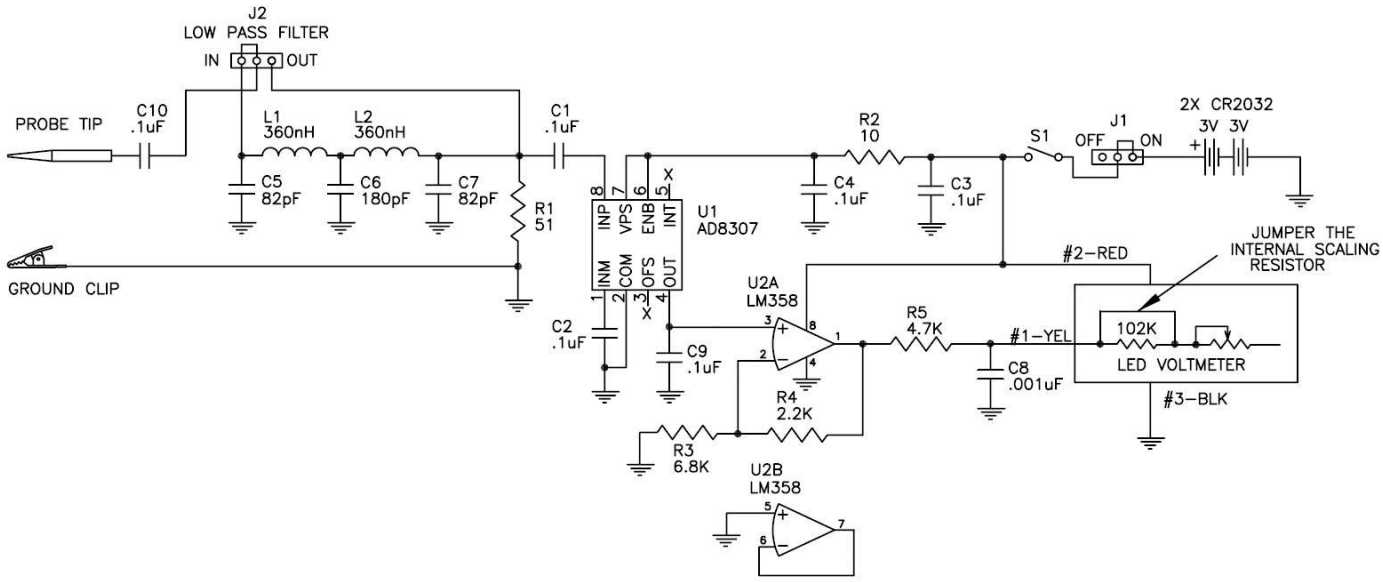
From Analog Devices AD8307 Datasheet



Our measured Relative Display Reading vs. Input Level (dBm) @ 10MHz

Thanks to Bob N7SUR for passing along his formula: "dbm = (LED Value X 3.5) – 84" and tape it to the back of the probe.

Schematic:



Notes: